PERFORMANCE CHARACTERISTICS OF LITHIUM ION POLYMERIC ELECTROLYTE CELLS

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Lithium polymeric electrolyte rechargeable cells are being actively developed for several applications such as consumer electronics and electric vehicles. One of the advantages associated with the use of polymeric electrolyte is a reduced propensity for lithium dendrites and enhanced interfacial stability as compared to liquid-based electrolytes. However, the problems related to dendrites and reactivity are not completely eliminated at the lithium electrodes. The development in liquid-based cells is focused on the use of lithium-carbon anodes (termed as lithium ion) in place of metallic lithium to reduce the dendrites and thus improve the cycle life. Additionally, the replacement of lithium with lithium-carbon reportedly improves the safety of the cells. An extension of this concept, i.e., use of Li -C for Li, to the polymeric electrolyte cells is thus expected to further reduce the problems of dendrites and interfacial instability in Li polymer cells. The electrochemical performances of the individual components such as carbon anode and polymeric electrolyte arc described below.

The carbon electrode consists of a commercial graphite subjected to a pretreatment process identified in our earlier studies in organic liquid electrolytes. The carbon electrode gave 240 mAh/gm capacity at C/10 rate. We have also investigated a number of both gelled and "true" polymer electrolytes including Polyacrylonitrile (PAN) and Polyethylene Oxide (PEO)-based materials. While the PAN-based electrolyte gave 10^{-3} (S cm^{-1}) conductivity at room temperature, PEO based electrolyte gave 10^{-3} (S cm^{-1}) conductivity at 60°C. The selected carbon anode and electrolyte materials are being used in conjunction with lithium cobalt oxide composite cathode to fabricate Li ion-polymer cells. The electrodes are scaled in a polyethylene laminated aluminum foil using a scaling technique developed at JPL. These cells will be tested for rate capability, cycle life and charge retention. In this work, the performance characteristics of such lithium ion polymeric electrolyte cells are examined.